Chapter 2. Employment, Hours, and Earnings from the Establishment Survey

BLS cooperates with State employment security agencies in the Current Employment Statistics (CES) survey to collect data each month on employment, hours, and earnings from a sample of nonfarm establishments (including government). In early 1996, this sample included over 390,000 reporting units. From these data, a large number of employment, hours, and earnings series in considerable industry and geographic detail are prepared and published each month. The employment data include series on all employees, women workers, and production or nonsupervisory workers. Hours and earnings data include average weekly hours, average weekly overtime hours, and average hourly and weekly earnings. For many series, seasonally adjusted data also are published.

IN THIS CHAPTER

Background

The first monthly studies of employment and payrolls by BLS began in 1915 and covered four manufacturing industries. Before 1915, the principal sources of employment data in the United States were the census surveys—the decennial Census of Population and the quinquennial Census of Manufactures. No regular employment data were compiled between the censuses.

In 1916, the BLS survey was expanded to cover employment and payrolls in 13 manufacturing industries; by 1923, the number had increased to 52, and by 1932, 91 manufacturing and 15 nonmanufacturing industries were covered by a monthly employment survey.

With the deepening economic crisis in 1930, President Hoover appointed an Advisory Committee on Employment Statistics which recommended extension of the Bureau's program to include the development of hours and earnings series. In 1932, Congress granted an increase in the BLS appropriation for the survey. In 1933, average hourly earnings and average weekly hours were published for the first time for total manufacturing, for 90 manufacturing industries, and for 14 nonmanufacturing categories.

During the Great Depression, there was controversy concerning the actual number of unemployed people; no reliable measures of employment or unemployment existed. This confusion stimulated efforts to develop comprehensive estimates of total wage and salary employment in nonfarm industries, and BLS survey data produced such a figure for the first time in 1936.

Interest in employment statistics for States and areas also grew. Even before BLS entered the field in 1915, Massachusetts, New York, and New Jersey were preparing employment statistics. In 1915, New York and Wisconsin entered into cooperative agreements with BLS, whereby sample data collected from employers by a State agency would be used jointly with BLS to prepare State and national series. By 1928, five other States had entered into

such compacts, and another five were added by 1936. By 1940, estimates of total nonfarm employment for all 48 States and the District of Columbia were available. In 1996, cooperative arrangements were in effect with all 50 States, the District of Columbia, Puerto Rico, and the Virgin Islands.

Since 1949, the Current Employment Statistics (CES) program has been a fully integrated Federal-State project which provides employment, hours, and earnings information by industry on a national, State, and area basis. Between 1991 and 1994, BLS expanded the published industry detail for the service-producing sector, bringing it closer to parity with the goods-producing sector. During this period, BLS also more than doubled the number of specific industries for which data were published at the first release to include all 2-digit-level industries under the Standard Industrial Classification System.

In 1996, BLS completed implementation of computer-assisted reporting through telephone interviews, touch-tone self-reporting, and voice recognition systems, and introduced electronic data interchange. In June 1996, improvements to seasonal adjustment techniques were introduced. Comprehensive research is being conducted for a new survey design, to be phased in over several years.

Concepts

Establishment

An establishment is an economic unit, such as a factory, mine, or store, which produces goods or services. It is generally at a single location and engaged predominantly in one type of economic activity. Where a single location encompasses two or more distinct activities, these are treated as separate establishments, provided that separate payroll records are available and certain other criteria are met.

Employment

Employment is the total number of persons employed full or part time in nonfarm establishments during a specified payroll period. Temporary employees are included. In general, data refer to persons who worked during, or received pay for, any part of the pay period that includes the 12th of the month, which is standard for all Federal agencies collecting employment data from business establishments. National employment figures for Federal Government establishments, however, represent the number of persons who were paid for the last full pay period of the calendar month except for the Department of Defense, which reports the number of civilian employees on the payroll the last day of the month; intermittent Federal Government workers are counted if they performed any service during the month.

Workers on an establishment payroll who are on paid sick leave (when pay is received directly from the employer); on paid holiday or vacation; or who work during only a part of the specified pay period, even though they are unemployed or on strike during the rest of the pay period, are all counted as employed. Persons on the payroll of more than one establishment during the pay period are counted in each establishment which reports them, whether the duplication is due to turnover or dual jobholding. Persons are considered employed if they receive pay for any part of the specified pay period, but they are not considered employed if they receive no pay at all for the pay period. Since proprietors, the self-employed, and unpaid family workers do not have the status of paid employees, they are not included. Also excluded from the employed are domestic workers in households; persons who are on layoff, on leave without pay, or on strike for the entire pay period; and persons who were hired but have not yet started work during the pay period. The employment statistics for government refer to civilian employees only. All persons who meet these specifications are included in the designation "all employees," regardless of industry.

In addition to employment data for *all employees*, the survey also collects data on a major category of workers in each industry, differentiated primarily to ensure the expeditious collection of current statistics on hours and earnings. These groups of employees are designated production workers, construction workers, or nonsupervisory workers, depending upon the industry.

Data are collected for *production workers* in manufacturing and mining industries. In manufacturing, this group covers employees, up through the level of working supervisors, who engage directly in the manufacture of the establishment's product. Among those excluded from this category are persons in executive and managerial positions and persons engaged in activities such as accounting, sales, advertising, routine office work, professional and technical functions, and force-account construction. (Force-account construction is construction work performed by an establishment, primarily engaged in some business other than construction, for its own account and for use by its own employees.) Production workers in mining are defined in a similar manner. A more detailed description of the classes of employees included in the production and nonproduction worker categories in manufacturing is shown on the facsimile of the BLS 790 C schedule at the end of this chapter.

In construction, the term *"construction workers"* covers workers, up through the level of working supervisors, who are engaged directly on the construction project either at the site or in shops or yards at jobs ordinarily performed by members of construction trades. Excluded from this category are executive and managerial personnel, professional and technical employees, and workers in routine office jobs.

In the remaining private sector industries (transportation, communications, and public utilities; wholesale and

retail trade; finance, insurance, and real estate; and services) data are collected for *nonsupervisory workers*. Nonsupervisory workers include most employees except those in top executive and managerial positions. (See facsimile of BLS 790 E, the reporting form for wholesale and retail trade.)

An employment benchmark is a reasonably complete count of employment used to adjust estimates derived from a sample. Adjustment is usually done annually. The basic source of benchmark data for the CES survey is data on "all employees" collected from employers by State employment security agencies as a byproduct of the unemployment insurance (UI) system. About 98 percent of all employees on nonfarm payrolls are covered by the UI system. The compilation and use of benchmark data are explained in detail in later sections of this chapter.

Hours and earnings

The hours and earnings series are based on reports of gross payrolls and the corresponding paid hours for production workers, construction workers, or nonsupervisory workers. (See facsimile of BLS 790 C.) In private educational institutions, payroll data are for "all employees."

Aggregate payrolls include pay before deductions for Social Security, unemployment insurance, group insurance, withholding tax, salary reduction plans, bonds, and union dues. The payroll figures also include pay for overtime, shift premiums, holidays, vacations, and sick leave paid directly by the employer to employees for the pay period reported. They exclude bonuses, commissions, and other lump-sum payments (unless earned and paid regularly each pay period or month), or other pay not earned in the pay period concerned (e.g., retroactive pay). Tips and the value of free rent, fuel, meals, or other payments in kind are not included.

Total hours during the pay period include all hours worked (including overtime hours), hours paid for standby or reporting time, and equivalent hours for which employees received pay directly from the employer for sick leave, holidays, vacations, and other leave. Overtime or other premium pay hours are not converted to straight-time equivalent hours. The concept of total hours differs from scheduled hours or hours worked. The average weekly hours derived from the total hours reflect the effects of such factors as unpaid absenteeism, labor turnover, part-time work, and strikes, as well as fluctuations in work schedules.

Overtime hours are hours worked for which premiums were paid because they were in excess of the number of hours of either the straight-time workday or workweek. Saturday and Sunday hours (or 6- and 7th-day hours) are included as overtime only if overtime premiums were paid. Holiday hours worked as overtime are not included unless they are paid for at more than the straight-time rate. Hours for which only shift differential, hazard, incentive, or similar types of premiums were paid are excluded from overtime hours. Overtime hours data are collected only from establishments in manufacturing industries.

Average hourly earnings series, derived by dividing gross payrolls by total hours, reflect the actual earnings of workers, including premium pay. They differ from wage rates, which are the amounts stipulated for a given unit of work or time. Average hourly earnings do not represent total labor costs per hour for the employer, because they exclude retroactive payments and irregular bonuses, employee benefits, and the employer's share of payroll taxes. Earnings for those employees not covered under the production worker and nonsupervisory categories are not reflected in the estimates.

Real earnings data (those expressed in 1982 dollars) result from the adjustment of average hourly and weekly earnings by means of the Bureau's Consumer Price Index for Urban Wage Earners and Clerical Workers (CPI-W); they indicate the changes in the purchasing power of money earnings as a result of price changes for consumer goods and services. These data cannot be used to measure changes in living standards as a whole, which are affected by other factors such as total family income, the extension and incidence of various social services and benefits, and the duration and extent of employment and unemployment. The long-term trends of these earnings data are also affected by changing mixes of full-time/part-time workers, high-paid/low-paid workers, etc.

Straight-time average hourly earnings are approximated by adjusting average hourly earnings by eliminating only premium pay for overtime at a rate of time and one-half. Thus, no adjustment is made for other premium payment provisions such as holiday work, late shift work, and premium overtime rates other than those at time and one–half. Straight-time average hourly earnings are calculated only for manufacturing industries because data on overtime hours are not collected in other industries.

Industrial classification

Industrial classification refers to the grouping of reporting establishments into industries on the basis of their major product or activity as determined by the establishments' percentages of total sales or receipts for the previous calendar year. This information is collected as an administrative byproduct of the UI reporting system. All data for an establishment making more than one product or engaging in more than one activity are classified under the industry of the most important product or activity, based on the percentages reported.

Industries are classified in accordance with the 1987 *Standard Industrial Classification Manual*, Office of Management and Budget. (See appendix B of this bulletin for a description of this classification system.)

Data Sources and Collection Methods

Sample data

Each month, the State agencies cooperating with BLS in the survey collect data on employment, payrolls, and paid hours from a sample of establishments. Data are collected through various types of electronic means from about two-thirds of the respondents; the remainder use mail or fax. The primary type of electronic reporting is touch-tone phone self-response; others are computer-assisted phone interviews and phone voice recognition technology. Data are collected through electronic data interchange from a small but growing number of companies that have a large number of establishments across the country.

The respondents extract the requested data from their payroll records, which must be maintained for a variety of tax and accounting purposes. All firms with 250 employees or more are asked to participate in the survey, as well as a sample of smaller firms. Together, they comprise the largest monthly employer survey in existence, with a sample of over 390,000 establishments. Despite the voluntary nature of the survey, numerous establishments have reported regularly for many years.

A "shuttle" schedule (BLS form 790 series) is used for mail respondents. It is submitted each month by the respondent, edited by the State agency, and returned to the respondent for use again the following month. The shuttle schedule has been used since 1930, but there have been substantial changes in its design and in the data collected. The report forms are basically alike for each industry, but there are several variants tailored to the characteristics of different industries. Firms that report using one of the methods of phone collection are provided a form similar to a shuttle schedule to keep as their record of the data they report each month.

The design of the shuttle schedule and record form is particularly important in maintaining continuity and consistency in reporting from month to month. The use of a single form for the entire year automatically exhibits the trends of the reported data covered by the schedule during the year; therefore, the relationship of the current data to the data for the previous months is shown. The shuttle schedule for reporting by mail also has operational advantages. For example, accuracy and economy are achieved by entering the identification codes and the address of the reporter only once a year.

All reported data, regardless of method of collection, are edited by the State agencies each month to make sure that the information is correctly reported and that it is consistent with the data reported by the establishment in earlier months and with the data reported by other establishments in the industry. The State agencies electronically transmit the data to BLS-Washington. At BLS, the data are edited again by computer to detect processing and reporting errors which may have been missed in the initial State editing. When questionable reports are discovered at any stage of the editing process, the person responsible for the initial collection of the data contacts the respondent for clarification or correction. The edited data are used by BLS-Washington staff to prepare national estimates of employment, hours, and earnings. States also use the data to develop State and area estimates.

It should be noted that for employment, the sum of the State figures will differ from the official U.S. national totals because of the effects of differing industrial and geographic stratification, a higher variance associated with the aggregation of estimates across States, and differences in the timing of benchmark adjustments.

Benchmark data

Since about 1940, the basic source of benchmark information for "all employees" has been the periodic tabulations compiled by State employment security agencies from reports of establishments covered under State UI laws.

The State employment security agencies receive quarterly reports from each employer subject to the UI laws showing total employment in each month of the quarter and the total quarterly wages for all employees. The State agencies submit tabulations of these reports to BLS-Washington each quarter. (See chapter 5.)

For the few industries exempt from mandatory UI coverage, other sources are used for benchmark information. For example, data on employees covered under Social Security laws, published by the Bureau of the Census in *County Business Patterns*, are used to augment the UI data for religious organizations, private schools, and interns and trainees in hospitals. Data for interstate railroads are obtained from the Interstate Commerce Commission.

The Federal Government employment series is a complete count provided monthly by the Office of Personnel Management and, therefore, a benchmark is not necessary. The UI data for State and local government employment are supplemented as necessary with Bureau of the Census data derived from the Census of Governments for local elected officials and certain other groups. A short description of the benchmark process is given in the section on estimating procedures for employment, below.[1]

Sample Design

BLS uses sampling in the CES survey to collect data in most industries, because full coverage would be prohibi-

[1] For a more detailed description of the benchmarking process, see Patricia M. Getz, "BLS Establishment Estimates Revised to Incorporate March 1995 Benchmarks," *Employment and Earnings, June 1996.*

tively costly and time consuming. The sampling plan for the program must: (a) Provide for the preparation of reliable monthly estimates of employment, hours of work, and hourly and weekly earnings, which can be published promptly and regularly; (b) through a single, general system, yield considerable industry detail for the Nation, States, and metropolitan areas; (c) be appropriate for the existing framework of operating procedures, administrative practices, resource availability, and other institutional characteristics of the program; and (d) provide maximum accuracy at minimum cost.

The primary sampling design is stratified sampling of establishments, which produces an efficient and equitable sample distribution by stratifying the universe of establishments by industry and size class groupings. Under optimum allocation, a larger sample is required for a stratum that has a large number of units, a high degree of variability between these units, or both.

Under the assumption that the standard deviation of establishment employments within a stratum is proportional to the average size of the establishments within that stratum, optimum allocation for this sample design is proportional to total stratum employment. A total sample size sufficient to produce adequate employment estimates is determined and distributed among the size classes in each industry based on total employment in the industry/size class stratum (i.e., relative importance of each size class to its industry). In practice, this amounts to distributing the total number of establishments needed in the sample among the cells according to the ratio of the employment in each cell to the total employment in the industry.

The probability that an establishment will be selected depends upon which employment size class stratum it is in. Large establishments are certain of selection; smaller ones have less chance. Within each stratum, sample members are selected using sampling ratios determined from the sample allocation. In nearly all industries, establishments with 250 or more employees are included in the sample with certainty; in many industries, the cutoff is lower. In a manufacturing industry in which a high proportion of total employment is concentrated in relatively few large establishments, a high percentage of total employment is included in the sample. Consequently, the sample design for such industries provides for a complete census of the large establishments with only a few chosen from among the smaller establishments. On the other hand, in an industry where a large proportion of total employment is in small establishments, the sample design calls for the inclusion of all large establishments, and also for a substantial number of the smaller establishments. Many industries in the trade and services divisions fall into this category.

BLS-Washington develops the sample requirements for each State based on this design. The States have drawn the sample over time from their UI universe file. As the sample falls below the required amount in a sampling cell due to attrition, the State draws additional sample members.

This sample design, although aimed primarily at meeting the requirements for national estimates, provides a technical framework within which State and area needs can be met. This sample design reduces geographic bias and reduces large-firm bias by giving smaller firms proper representation in the sample. Because the estimates for States and areas generally are not prepared at the same degree of industry detail as the national estimates, it may be necessary to modify the national sampling ratios in order to obtain a sufficient sample. The additional reports needed for State and area samples are added to the sample required by the national design.

Stratification

Since 1959, when all-employee benchmark data stratified by employment size became available, estimates have been prepared using a cell structure which uses size and, in some cases, regional stratification. In preparing the estimates, the nine size classes used for sampling are usually combined into no more than five size classes when stratification by size is needed.

Stratification by size class and geographic region was originally introduced to improve estimating efficiencies for the hours and earnings data series. There was an observed heterogeneity in earnings levels, particularly among establishments of different sizes and in geographic areas for particular industries. Because there is no universe data available for hours and earnings, sample averages data were used to specify strata using the following procedure.

National estimates of average weekly hours and average hourly earnings were prepared using eight size strata and four regional strata (Northeast, Midwest, South, and West); this represented the maximum stratification possible. These estimates served as a standard against which the published averages were compared. If this comparison indicated a need for regional and/or size stratification, these strata were created.

Later research, conducted in the early 1980s, indicated gains in employment estimation efficiencies also could be realized by detailed size stratification in the trade and services industries. These industries have relatively larger percentages of employment concentrated among small employers, which tend to grow at rates different from large employers. Stratification into four or five size classes in most industries within these divisions was implemented in the mid-1980s to capture the efficiencies. Employment is the primary characteristic of interest in the CES program; thus, size stratification patterns developed to improve employment estimates in trade and services took precedence over stratification derived from hours and earnings patterns.

Estimating Procedures

Employment

Employment estimates are made at what is termed the basic estimating cell level and aggregated upward to broader levels of industry detail by simple addition. Basic cells are defined by industry (usually at the 3- or 4-digit SIC level) and are stratified within industry by geographic region and/or size class in the majority of cases. Within the wholesale trade, retail trade, and services divisions, most industries are stratified into three to five size classes (beginning in 1984) because research demonstrated that estimates produced under this scheme require less benchmark revision. (See earlier section on benchmarks.) For other divisions, size and region strata are used when they improve the hours and earnings estimates.

To obtain all-employee estimates for a basic estimating cell, the following three steps are necessary:

1. A total employment figure (benchmark) is obtained for the basic estimating cell as of a specified month (usually March).

2. For each cell, the ratio of all employees in 1 month to all employees in the preceding month (i.e., the link relative) is computed for sample establishments which reported for both months.

3. Beginning with the benchmark month, the all-employee estimate for each month is obtained by multiplying the all-employee estimate for the previous month by the link relative for the current month.

The following example illustrates how the estimating procedure is applied in preparing a series. Assume that the estimate of all employees for a given cell was 50,000 in July. The sample, comprised of 60 establishments that reported both months, had 25,000 employees in July and 26,000 in August, a 4-percent increase. To derive the August estimate, the change for identical establishments reported in the July-August sample is applied to the July estimate:

$$50{,}000 \times \frac{26{,}000}{25{,}000} = 52{,}000$$

This procedure, known as the link relative technique, is efficient in that it takes advantage of a reliable, complete count of employment and of the high correlation between levels of employment in successive months in identical establishments.

Most national employment estimates are multiplied by bias adjustment factors to produce the monthly published estimates. Bias adjustment factors are used primarily to compensate for the inability to capture the entry of new firms on a timely basis. New firms contribute a substantial amount to employment growth each year, but there is a lag between the creation of a firm and its inclusion on the sample frame, i.e., the UI universe file. It is, therefore, necessary to use modeling techniques to capture this segment of the population. Without bias adjustment, the sample survey alone would seriously understate employment totals. The bias adjustment factors are derived based on a 3-year average of differences between benchmarks and sample estimates, and the rate of employment change in the most recent quarter. The 3-year average provides a baseline bias factor which takes into account a moving average of historically observed differences between purely sample–based estimates and complete population counts of benchmarks. The rate-of-change component enhances the sensitivity of the factors to recent trends in employment change. When employment grows at an increasing rate, a larger bias adjustment is necessary. When employment growth slows or declines overall, smaller adjustments are required.

To obtain estimates of production (or construction or nonsupervisory) worker employment, the ratio of production workers to all employees in the sample is assumed to equal the same ratio in the universe. The current month's production worker ratio is thus estimated and then multiplied by the all-employee estimate. The difference link and taper formula, described below in the section on hours and earnings, is used to estimate the current month's production worker ratio. This formula adds the change in the matched sample's production worker ratio (the link) to the prior month's estimate, which has been slightly modified for changes in the sample composition (the taper). A similar method is adopted to estimate the number of women workers.

The estimates for each type of series (all employees, production workers, and women workers) for individual basic estimating cells are summed to obtain corresponding totals for broader industry groupings and divisions.

All estimates back to the most recent benchmark month are subject to revision each year when new benchmarks become available. Because of the complexity of developing benchmarks, they are not available until at least 15 months after the benchmark month (usually March). For example, the revised estimates based on the March 1995 benchmarks were released in June 1996. The inter-benchmark revision period extended from April 1994 through February 1995. Estimates based on the new benchmark level also were released at that time for the post-benchmark period—April 1995 through May 1996. Subsequent estimates also are based on the 1995 benchmark levels until release of the 1996 benchmark.

To determine the appropriate revisions, the new benchmarks for March are compared to the estimates previously made for that month. The differences represent: 1) Estimating errors that accumulated since the previous bench-

Table 1. Percent differences between nonfarm employment estimates and benchmarks by industry, March 1993-95

Industry	1993	1994	1995
Total	0.2	0.7	0.5
Mining	2.2	-.7	.2
Construction	1.6	1.9	-1.6
Manufacturing	1.1	1.3	.3
Transportation and public utilties	1.0	2.2	-.7
Wholesale trade	-2.6	1.2	1.2
Retail trade	-.2	1.3	1.6
Finance, insurance, and real estate	1.5	2.1	-1.8
Services	.1	-.8	.9
Government	-.1	.4	.2

mark revision and 2) corrections to establishments' industry classification. These differences are assumed to have accumulated at a regular rate. The all-employee estimates are wedged, or tapered, in order to smooth out the differences between the new and old benchmarks. Estimates for the 15 months subsequent to the benchmark month are revised by applying the previously computed sample link relative to the new benchmark level. Estimates for women workers and production workers are recomputed using the revised all-employee estimates and the previously computed sample ratios of these workers to all employees.

Although national all-employee series generally are adjusted by this wedging technique, the benchmark source figures may replace the CES monthly estimates in a few cases where doing so results in more accurate levels and trends. (In States, the replacement technique predominates.) A comparison of the national revisions made in recent years is presented in table 1.

Hours and earnings

Independent benchmarks are not available for the hours and earnings series; consequently, the levels derive directly from the CES sample averages.

Average weekly hours and average hourly earnings. To obtain average weekly hours for a basic estimating cell, the sum of the worker hours that the establishments classified in the cell reported is divided by the total number of production workers reported for the same establishments. In computing average hourly earnings, the reported payroll is divided by the reported worker hours for the same establishments.

First, the unmodified sample averages of average weekly hours and average hourly earnings are modified at the basic estimating cell level by a wedging technique designed to compensate for month-to-month changes in the sample of reporting establishments.

For example, unmodified sample averages for the current month, $\bar{x}_c$ is obtained from aggregates from a matched sample of establishments reporting for both the current month and the previous month. Similarly, unmodified sample averages for the previous month, x_p, is calculated from the same matched sample. $x_c - x_p$ is a measure of the change between the 2 months.

Note is then taken of the estimate of average hourly earnings for the previous month, X_p. Because the panel of establishments reporting in the sample is not fixed from month to month, X_p and x_p may differ. An estimate for the current month, X_c, is obtained by using both pieces of information:

$$\bar{X}_c = (O.9X_p + O.1x_p) + (x_c - x_p)$$

The procedure reflected in this formula has the following advantages: (1) It uses matched sample data; (2) it tapers the estimate toward the sample average for the previous month of the current matched sample (x_p) before applying the current month's change; and (3) it promotes continuity by heavily favoring the estimate for the previous month (X_p) when applying the numerical factors.

The user may modify the formula if the difference between X_p and x_p is great and if there is reason to believe it will be sustained (e.g., it results from a new sample member with significantly different hours or earnings). This is done by changing the numerical factors from 0.9 and 0.1 to 0.8 and 0.2, or 0.7 and 0.3, etc., or by using a special wedging procedure when the difference exceeds 3 percent in the same direction for 3 consecutive months.

Average weekly hours and average hourly earnings for industries and groups above the basic estimating cell level are weighted averages of the figures for component cells. The average weekly hours for each basic estimating cell are multiplied by the corresponding estimate of the number of production workers to derive aggregate worker hours. Payroll aggregates are the product of the aggregate worker hours and average hourly earnings. The payroll and worker hour aggregates for industry groups and divisions are the sum of the aggregates for the component industries.

Average weekly hours for industry groups are obtained by dividing the worker hour aggregates by the corresponding production worker estimates. Average hourly earnings for industry groups are computed by dividing the payroll aggregates by the worker hour aggregates. This method is equivalent to weighting average weekly hours by the estimated number of production workers in the universe and weighting average hourly earnings by the estimated worker hours for the universe.

For all levels, from basic estimating cells to major industry divisions, average weekly earnings are computed by multiplying average hourly earnings by average weekly hours.

Overtime hours. Average weekly overtime hours are estimated in basically the same way as average weekly hours.

Overtime worker hour sample averages are used in the computations rather than the sample averages for total worker hours. The sample totals for production workers used in the computations are those for the reports containing overtime worker hours (including those reporting zero hours) as well as production workers, total payroll, and total worker hours. The wedging technique and the summary level estimating technique also are comparable to those used to estimate average weekly hours.

Average hourly and weekly earnings in 1982 dollars. Average hourly and weekly earnings are computed and published in terms of 1982 dollars to give an approximate measure of changes in "real" average earnings (earnings in constant dollars). These series are computed by dividing the average hourly and weekly earnings (in current dollars) by the BLS Consumer Price Index for Urban Wage Earners and Clerical Workers (CPI–W) (1982 = 100) for the same months.

Average hourly earnings, excluding overtime, for manufacturing industries. These are computed by dividing the total production worker payroll for an industry group by the sum of the total production worker hours and one-half of the total overtime worker hours, which is equivalent to the payroll divided by straight-time hours. This method excludes overtime earnings at an assumed rate of 1 1/2 times the straight-time rates; no further adjustment is made for other premium payment provisions.

Indexes of aggregate weekly hours and payrolls. These indexes are prepared by dividing the current month's aggregates by the annual average aggregate for 1982. The hours aggregates are the product of average weekly hours and production or nonsupervisory worker employment; the payroll aggregates are the product of the hours aggregates and average hourly earnings.

Indexes of diffusion of employment changes. These indexes measure the dispersion among industries of the change in employment over the specified time span. The overall indexes are calculated from 356 seasonally adjusted employment series (3-digit industries) covering all nonfarm payroll employment in the private sector. The manufacturing indexes are based on 139 3-digit industries. Each component series is assigned a value of 0, 50, or 100 percent, depending on whether its employment showed a decrease, no change, or an increase over a given time period. The average (mean) value is then calculated, and this percent is the diffusion index number. The reference point for interpreting the diffusion indexes is 50 percent, the value which indicates that the same number of component industries have increased as have decreased. The direction and distance of the index number from the 50 percent reference point indicate whether growing (above 50) or declining (below 50) industries predominate and by what magnitude. The margin between the percentage of industries that increased and the percentage that decreased employment equals twice the difference between the index number and 50 percent.

Seasonally adjusted series

Many economic statistics reflect a regularly recurring seasonal movement which can be measured from past experience. By eliminating that part of the change attributable to the normal seasonal variation, it is possible to observe the cyclical and other nonseasonal movements in these series. Seasonally adjusted series are published regularly for selected employment, hours, and earnings series. The number of industries for which seasonally adjusted employment estimates are published nearly doubled to 118 from 1993 to 1995.

In June 1996, X-12 ARIMA software, developed by the U.S. Bureau of the Census, replaced X-11 ARIMA as the method used for seasonal adjustment of the CES data. Using special features of X-12 ARIMA, adjustments were made for the first time to remove the effect of the variable number of weeks between surveys from month to month (about 1 month in 3 has a 5-week instead of a 4-week interval). Other adjustments previously made outside of X-11 ARIMA for moving holidays and for variable numbers of November election poll workers from year to year also were first performed under the special features of X-12 ARIMA at that time. Seasonally adjusted estimates were revised back to January 1988, using the X-12 ARIMA software.

The seasonally adjusted series are computed by dividing the unadjusted series by the appropriate seasonal adjustment factors. Seasonally adjusted employment series for broader industry groups are obtained by summing the seasonally adjusted data for the component industries. Seasonally adjusted hours and earnings averages for broader level industry groups are weighted averages of the seasonally adjusted component series.

Presentation

The CES program has continued to improve and expand since its inception; it currently uses payroll reports from over 390,000 establishments to provide monthly estimates of employment, hours, and earnings in considerable industry detail. National estimates are published for all of the 2-digit SIC level industries, 70 percent of the 3-digit SIC level industries, and 35 percent of the 4-digit SIC level industries. As part of an ongoing effort to increase data availability for the services sector, BLS published estimates for

55 additional industries in the service-producing sector between 1991 and 1995. This brings the total to:

SIC level	Number of service-producing industries
2-digit	40 (all)
3-digit	120
4-digit	92

At the national level, the CES program currently publishes more than 4,000 series each month. Tables 2, 3, and 4 summarize the published national detail by major industry division. Table 2 describes the primary series produced by the program, that is, those computed directly from the sample data. Table 3 indicates the special series obtained from the primary series by applying special adjustments, and table 4 lists the seasonally adjusted series.

In addition to the series published on a current monthly basis, employment in March of each year (based on benchmark data) is usually published in the June issue of *Employment and Earnings* for over 400 industries for which monthly estimates do not meet established publication standards.

The national series on employment, hours, and earnings appear in several BLS publications. The summary data are first published each month in *The Employment Situation* news release which contains preliminary national estimates of nonfarm employment, average weekly hours, and average hourly and weekly earnings in the preceding month, for major industries. The preliminary estimates are based on tabulations of data for less than the full sample (about 65 percent) to permit early release of these widely used economic indicators. This release is normally issued on Friday, 3 weeks after the week of reference for the data. The news release also includes a brief analysis of current trends in employment, hours, and earnings.

Most of the national estimates at the level of detail described in tables 2, 3, and 4 are published monthly in *Employment and Earnings*. The summary data are in the issue available about 5 weeks after the week of reference; preliminary estimates for the full industry detail, based on about 85 percent of the sample, are in the following month's issue. Final (pre-benchmarked) figures are issued 1 month later. Special articles describe technical developments in the program. The *Monthly Labor Review* also presents many of the national series as well as articles exploring industry employment trends.

Historical national statistics (monthly data and annual averages) derived from the CES program appear in *Employment, Hours, and Earnings, United States, 1909–94* (Bulletin 2445). Following each benchmark revision, a bulletin which contains all revised data is published. For example, bulletin 2481, issued in August 1996, reflects all revisions resulting from the introduction of the March 1995 benchmarks.

Published employment, hours, and earnings data also are available on the INTERNET. They can be accessed directly at http://stats.bls.gov:80/cgi-bin/dsrv?ee. or through the homepage at http://stats.bls.gov/ceshome.htm, which also provides extensive documentation on the program. National data also are disseminated in the publications or on-

Table 2. Number of "primary" national series on employment, hours, and earnings published from the Current Employment Statistics Program, by industry, June 1996

Industry	All employees	Production or nonsupervisory workers[1]	Women workers	Average weekly hours	Average weekly overtime hours	Average hourly earnings	Average weekly earnings
Total	659	527	584	528	324	528	526
Total nonfarm	1	–	1	–	–	–	–
Total private	1	1	1	1	–	1	1
Goods-producing	1	1	1	1	–	1	1
Mining	13	11	9	11	–	11	11
Construction	15	15	15	15	–	15	15
Manufacturing	325	324	275	324	324	324	322
Service-producing	1	–	1	–	–	–	–
Private service-producing	1	1	1	1	–	1	1
Transportation and public utilties	37	23	32	24	–	24	24
Wholesale trade	49	22	49	22	–	22	22
Retail trade	52	39	52	39	–	39	39
Finance, insurance, and real estate	32	14	32	14	–	14	14
Services	106	76	104	76	–	76	76
Government	25	–	11	–	–	–	–

[1] Production workers in manufacturing and mining, construction workers in construction, and nonsupervisory workers in all other industries.

Table 3. Number of "special" national series on employment, hours, and earnings published from the Current Employment Statistics program by industry, June 1996

Industry	Indexes of aggregate weekly hours	Indexes of aggregate weekly payrolls	Average hourly earnings, excluding overtime	Average hourly earnings (1982 = 100)	Average weekly earnings (1982 = 100)
Total	35	35	23	11	11
Total private	1	1	–	1	1
Goods-producing	1	1	–	1	1
Mining	1	1	–	1	1
Construction	1	1	–	1	1
Manufacturing	25	25	23	1	1
Service-producing	1	1	–	1	1
Transportation and public utilities	1	1	–	1	1
Wholesale trade	1	1	–	1	1
Retail trade	1	1	–	1	1
Finance, insurance, and real estate	1	1	–	1	1
Services	1	1	–	1	1

Table 4. Number of "seasonally adjusted" national series on employment, hours, and earnings published from the Current Employment Statistics program by industry, June 1996

Industry	All employees	Production or nonsupervisory workers[1]	Women workers	Average weekly hours	Indexes of aggregate weekly hours	Average overtime hours	Average hourly earnings		Average weekly earnings	
							Current dollars	1982 dollars	Current dollars	1982 dollars
Total	117	34	38	32	35	3	11	3	9	3
Total nonfarm	1	–	1	–	–	–	–	–	–	–
Total private	1	1	1	1	1	–	1	1	1	1
Goods-producing	1	1	1	1	1	–	1	1	1	1
Mining	5	1	1	1	1	–	1	–	1	–
Construction	4	1	1	1	1	–	1	–	1	–
Manufacturing	28	24	22	24	25	3	1	–	1	–
Service-producing	2	1	2	1	1	–	1	1	1	1
Transportation and public utilities	12	1	1	1	1	–	1	–	1	–
Wholesale trade	3	1	1	1	1	–	1	–	1	–
Retail trade	11	1	1	1	1	–	1	–	1	–
Finance, insurance, and real estate	12	1	1	–	1	–	1	–	–	–
Services	28	1	1	–	1	–	1	–	–	–
Government	9	4	–	–	–	–	–	–	–	–

[1] Production workers in manufacturing and mining, construction workers in construction, and nonsupervisory workers in all other industries.

line databases of other Federal agencies, e.g., the Department of Commerce, the Board of Governors of the Federal Reserve System, and the Council of Economic Advisers. They also are regularly republished in summary form or for specific industries in many trade association journals, the labor press, and in general reference works.

In addition to the national estimates, BLS publishes in *Employment and Earnings* monthly employment estimates for all 50 States, the District of Columbia, Puerto Rico, the Virgin Islands, and 281 metropolitan areas.[2] These estimates

were adjusted to March 1995 benchmarks with the publication of January 1996 data. The employment series cover total nonfarm employment and major industry divisions (e.g., construction and manufacturing) for each State and area. Hours and earnings data generally are limited to manufacturing production workers only. Detailed industry data are available monthly in releases published by the cooperating State agencies. For most States, the reference month for State and area data is about 1 month later than that for the national data. State and area information also is available on the INTERNET. The State and area Current Employment Statistics homepage, http://www.bls.gov/790home.htm, contains extensive information related to the CES State and area program, including contacts, news releases, and data.

Comparison with the Current Population Survey

The payroll survey excludes unpaid family workers, domestic workers in private homes, proprietors, and other self-employed persons, all of whom are covered by the household survey. Moreover, the payroll survey counts a person who is employed by two or more establishments at each place of employment, but the household survey counts a person only once, and classifies him or her according to the major activity. Certain persons on unpaid leave for the entire reference period are counted as employed under the household survey but are not included in the employment count derived from the payroll survey. Over time, however, the two surveys show similar trends in employment.

The household survey emphasizes the employment status of individuals and also provides much information on the demographic characteristics (sex, age, race) of the labor force. The survey is not well suited to furnishing detailed information on the industrial and geographic distribution of employment. The establishment survey provides limited information on personal characteristics of workers, however, it is an excellent source for detailed industrial and geographic data. In addition, it provides hours and earnings information which relates directly to the employment figures. The payroll and household surveys thus complement each other.

Uses

Data from the Current Employment Statistics program, along with the Current Population Survey data, are usually the first major economic indicators to be released each month. As such, they are used in the formulation of fiscal and economic policy. CES employment estimates are the primary component of the Index of Coincident Economic Indicators and have proved to be an extremely reliable measure of current economic activity. The manufacturing average weekly hours series is used in the Index of Leading Economic Indicators, which predicts swings in the business cycle.

Aggregate earnings data are the major component of Personal Income in the National Income and Product Accounts. Productivity measures (chapters 12 and 13) and the Industrial Production Index use aggregate hours. Indicating changes in the growth of individual industries, employment series are a basic input for employment projections by BLS (chapter 15 to be updated) and State employment security agencies.

The series also are used in the private sector by business firms, labor unions, universities, trade associations, and private research organizations to study economic conditions and to develop plans for the future. Business firms, for example, use the employment, hours, and earnings data for guidance in plant location, sales, and purchases. In addition, firms negotiating long-term purchase contracts often use escalation clauses based on the average hourly earnings series as an aid to adjust payments for changes in wages. Escalation clauses permit an adjustment of the contract price of the products or services being purchased depending on the movement of average hourly earnings in a selected industry.

Both labor and business have shown wide need for industry series on hourly earnings and weekly hours to provide a basis for labor-management negotiations. They not only furnish current and historical information on a given industry but also provide comparative data on related industries.

Reliability of Estimates

Although the relatively large size of the CES sample assures a high degree of accuracy, the estimates derived from it may differ from the figures that would be obtained if it were possible to take a complete census using the same schedules and procedures. Although the estimates are adjusted annually to new benchmarks, estimates subsequent to the benchmark month have several potential sources of error. The amount added each month for new establishments, for example, may be too high or too low. Changes in the industrial classification of establishments that result from changes in their product or activity between benchmark months are not reflected. In addition, small sampling and response errors may accumulate over several months as a result of the link relative technique of estimation used between benchmarks.

The hours and earnings estimates do not have universe

[2] Data for Puerto Rico and Virgin Islands are not used in compiling national estimates.

data sources available and therefore are not subject to benchmark revisions, although the broader industry groupings may be affected slightly by changes in production worker weights. Like the employment estimates, the hours and earnings estimates also are subject to sampling and nonsampling errors. Estimates of the sampling error for employment, hours and earnings were computed using the method of random groups and are expressed as relative standard errors (standard error divided by the estimate). If bias due to other sources of error is small, the chances are about 2 out of 3 that an estimate based on the sample would differ from the actual level by less than the standard error. The chances are 19 out of 20 that the difference would be less than twice the standard error.

Relative standard errors for employment, hours and earnings estimates, and detailed data on benchmarks, bias adjustments, and average revisions are provided in the Explanatory Notes and Estimates of Error Section of *Employment and Earnings.*

Survey Redesign

While the current sample design has resulted in relatively small errors, as measured by the annual benchmark revisions, there are some concerns that are being addressed in a redesign. The CES, survey which began over 50 years ago, predates the introduction of probability sampling as the internationally recognized standard for sample surveys. Instead, a quota sample has been used since its inception. Quota samples are known to be at risk for potentially significant biases, and recently completed BLS research suggests that, despite the large CES sample size, employment estimates based upon that sample at times diverge substantially from those that a more representative sample would have been expected to produce.

This lack of probability sample leads to an over-reliance on bias adjustment in the estimation procedure. Because bias adjustment is primarily based on past experience, it has the limitations common to all time series models in terms of ability to accurately reflect changing economic conditions on a timely basis. Thus, current research on a new survey design points toward introducing a probability-based sample with rotation among small and medium size firms (all large firms would still be asked to participate). This will more effectively insure a proper representation of the universe of nonfarm business establishments through randomized selection techniques and the regular rotation of sample members.

Estimation methods also will change to benefit from the probability design. Other areas under review include the concepts being measured and the frequency of benchmarking. Various aspects of the survey redesign will be phased in over several years, beginning in 1997.

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